Using a Socio-Environmental Economy to Maximize Sustainable Development Effectiveness

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Outline

1. Project and Program History
2. Development Benefit/Cost Ratios
3. Poverty-Reduction and Health Credits
4. Distribution and Transaction Costs
5. Defining Ownership for Assets and Growth
6. Project Plans and Possible Trajectories

Part 1
Project and
Program History

Program Development History

- **1993-1997: Sustainable energy research in Eritrea: improved stoves, wind and solar**
- **1999-2003: Initial scale-up of Eritrean improved stoves program**
- **2003-2005: Pilot test of rural solar home lighting finance scheme in Eritrea**
- **2002-Present: Scale-up of Eritrean improved stoves with some help from voluntary market carbon credits**
- **2006-Present: Combination of solar lights and stoves**
- **2007-Present: Creation of poverty-reduction and health credits and replication of development model to Ghana, Senegal, and Zanzibar**
- **2008: Sign-up of 100-200 villages: Senegal (>100), Zanzibar (1), Eritrea (40), Ghana (3)—Tentative commitment of $100K to invest**

Resulting Conclusions and Vision

- We need a new Socio-Environmental (SE) currency in which social and environmental value can be positively correlated with at least some type of compensation (i.e. SE 'Rewards Points')

- We need much more efficient distribution systems for getting maximum life-cycle benefit products to marginalized communities and distributing SE value to those who can value and pay for it

- 90% to 98% of the paid labor needs to be done by people in developing countries because people from rich countries are just far too expensive

- A focus needs to be made on productive asset and capital accumulation so scale-up and acceleration can be as rapid as possible—perhaps rates as high as 100% to 1000% per year

- B/C ratios need to be constantly improved and financial and organizational leverage needs to be applied so that a small diversion can be made for large resource flows, creating potentially 100:1 or 1000:1 improvements in B/C ratios

Last Year's (2007) Forecast

- By summer, decent set of video clips up on YouTube

- Village registry site up and running by about August

- Visit for possible Ghana projects in May, first pilot projects implemented in about a year

- Some credits (poverty, health, carbon?) for sale for Eritrea projects by about August

- Another 20 villages started by December

- 50-100 new projects/year in Eritrea and Ghana by about 2010?

Current Year (2008) Condition

- Raw media is available, but largely un-produced
- Village registry site beta test is up and running by January 2008
- Visit for Ghana projects in May, visit for projects in Senegal and Zanzibar in November
- $100K worth of poverty, health and carbon credits created and for sale (in beta-test) for Eritrea, Ghana, Zanzibar and Senegal by about January 2008
- Another 100 villages being signed up by April
- 200 new projects/year in Eritrea, Ghana, Senegal, and Zanzibar/Tanzania by about 2009?
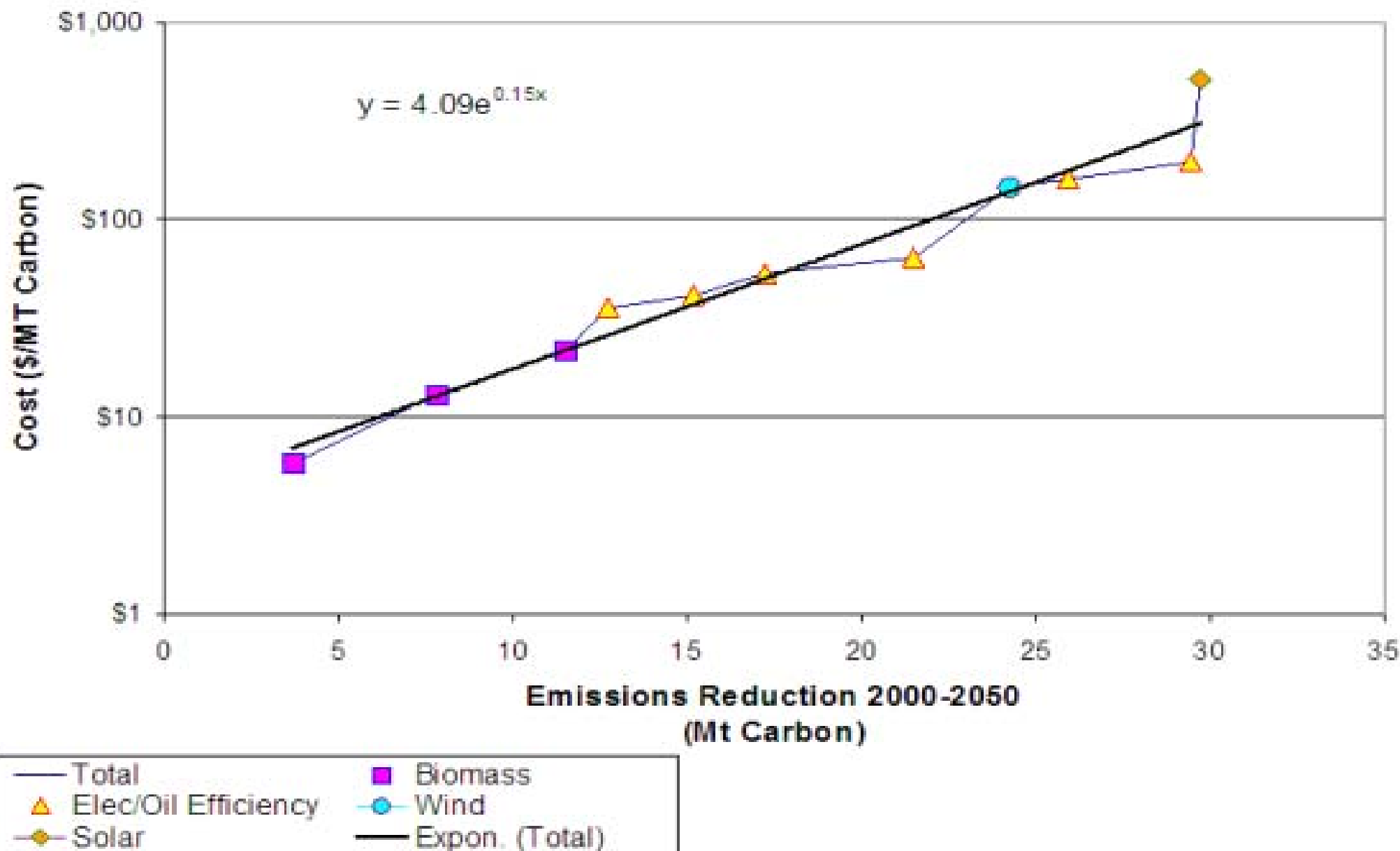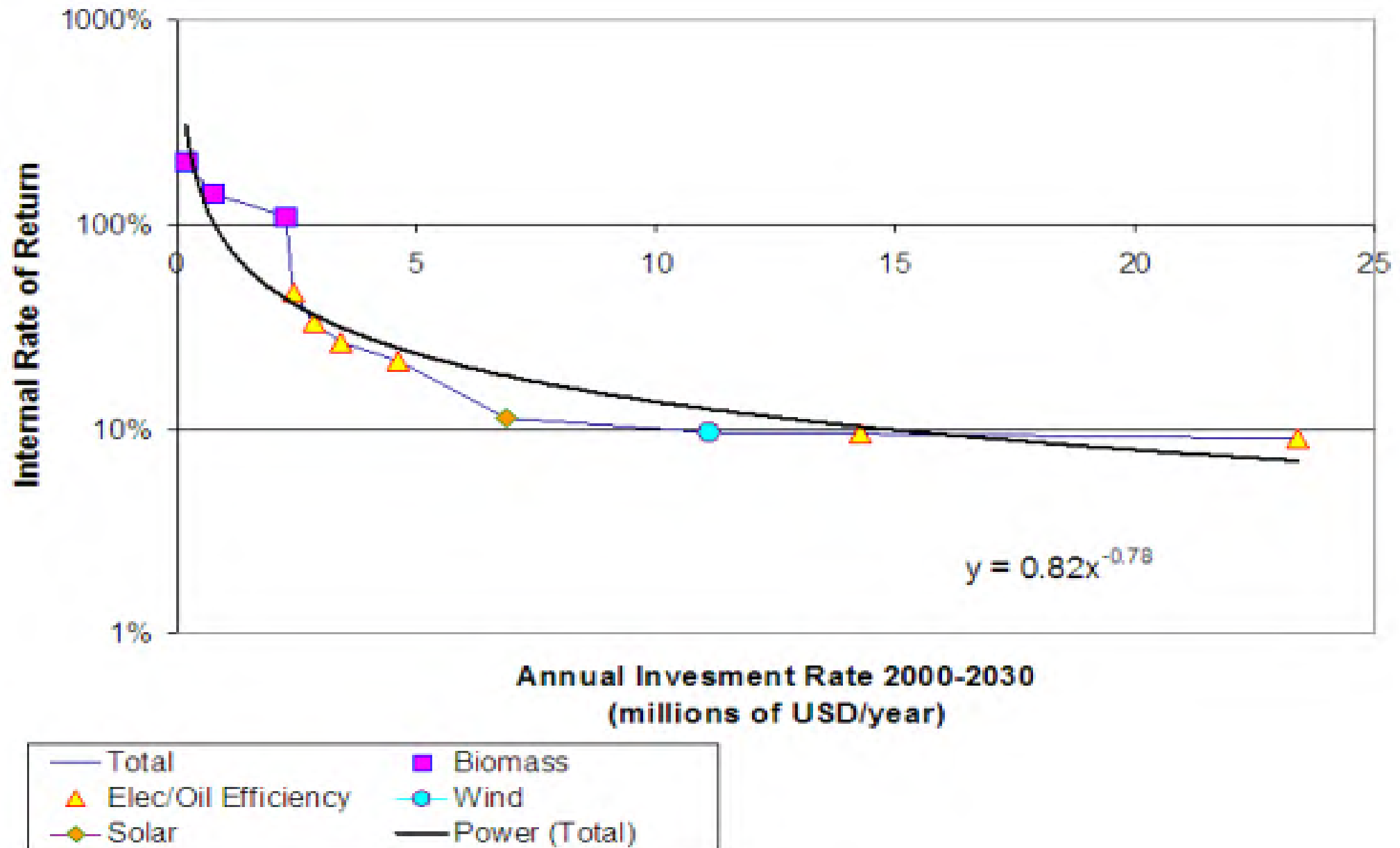
Part 2
Development
Benefit/Cost Ratios

Correlate Investments with B/C Performance

Example: Eritrean Emissions Reduction Supply Implied Log-Normal B/C Distribution

$$y = 4.09e^{0.15x}$$

Cost ($/MT Carbon) vs. Emissions Reduction 2000-2050 (Mt Carbon)

Legend:
- Total
- Elec/Oil Efficiency
- Solar
- Biomass
- Wind
- Expon. (Total)

Therefore: Wide Range of Environmental Returns on Investment

y = 0.82x^{-0.78}

Internal Rate of Return

Annual Investment Rate 2000-2030
(millions of USD/year)

— Total   ■ Biomass
△ Elec/Oil Efficiency   —●— Wind
—◆— Solar   — Power (Total)

Some Possible Consequences of Log-Normal B/C's

Efficiently correlating investment with performance can increase returns by an order of magnitude

Without information, a market for project impacts can be less than 10% efficient

Reduce Investment and Distribution Overheads

Allows More Service to More Remote Areas

Social Value Distribution:
   4 watts in remote rural village

Private Sector: 1 watt in urban area

International wholesale to consumer retail markups in Africa can increase consumer costs a factor of 2 – 5. Reducing this overhead allows more remote areas to get bigger benefits.

Have Beneficiaries Make In-Kind Contributions in Labor

Example: Stoves and Lights Project

In Eritrea, distributing 200 solar lighting systems can lead to the villager construction of 1000 improved stoves

In Zanzibar, villagers will build stoves for a $30 discount on a solar lighting system

In Ghana villagers will build stoves as part of a pre-condition for buying solar lights

This strategy can double project B/C ratios

Use Capital Financing Leverage

Loans Leverage Equity Capital

If the there is a monetized social and environmental value income stream, then this can be used to as collateral for loans

Typical equity capital to loan capital ratios are 1:2 to 1:4, so this allows an acceleration of investment by a factor of 2 to 4 compared to the saving rate generated by surplus cash accumulation

If the BC ratio on investments is high compared to the cost of loan financing (as they are on these projects) this can be used to accelerate returns on equity by a factor of 2-4

Leverage Even More By Investing in Distribution System Operating Capital

Distribution System Capital Requirements

Currently, solar lights are now economically feasible in rural Africa: Consumers can pay international wholesale price + 50% markup

A typical system costs $150 per household

It should be possible to roll-over operating capital ten times per year

Therefore $150 in operating capital can be used to purchase 10 systems per year, or 100 systems in 10 years

Distribution system operating capital investment has a leverage factor of 100

Summary of B/C Improvement Potential

Correlating investment with socio-environmental performance:

Improvement Factor: 10

Decreasing distribution overheads:

Improvement Factor = 2

Beneficiary in-kind contributions

Improvement Factor = 2

Loan financing leverage

Leverage Factor = 3 (range 2-4)

Distribution system operating capital leverage

Leverage Factor = 100

Total Leveraged B/C Improvement = 10*2*2*3*100 = 12000

Part 3
Poverty-Reduction and Health Credits

Poverty and Health Credits

Poverty Credits Measure Relative Labor Productivity Improvement: Can someone increase the value of their consumption and livelihood without increasing labor? People have only 40 to 60 hours per week. Anything that increases actual productivity usually leads to increased basic consumption Typical cost in Eritrea: A doubling of personal productivity costs about $100 direct capital investment.

Health Credits Measure Decrease in Disease Burden: Disablity-Adjusted Life Year (DALY) saved. Generally costs $50 - $200. Take current burden of disease (such as 0.05 DALY per year per person) and multiply by the fractional decrease in disease due to a particular measure (such as decreased indoor air pollution)

Poverty Metric Comments

- **Standard of Living measured in terms of basket of goods and services 'Purchasing Power Parity' income**

- **Poverty reduction measured as concrete labor productivity increase**

- **PPP/Cash income ratio is 5-10 for many developing countries**

- **Efficient investment in rural Eritrea converts cash investment to cash income at the rate of $1/year of income for about $1 invested.**

- **No new technologies needed!**

Poverty Metric Comments (cont)

- Cash incomes are often less than $100/person/year
- If efficiently invested it takes about $100/person investment to double incomes in rural Africa, producing $1000 PPP income/year for ten years (because of 10:1 PPP to cash income ratio)
- PPP Benefit/Cost ratio is therefore $10000 effective income over ten years for $100 invested or 100:1
- Because incomes are very low, the human benefit per dollar of effective income may be as much as 100 times higher than a typical U.S. investment
- This means that the human B/C ratio of an efficient investment in rural African can be 100*100 = 10,000 times higher than a typical investment in the U.S.

Some Development Credit Results

Summary of social and environmental credit values for project outputs

Output	Environ-ment (tons CO2) @ $20/ton		Poverty-Reduction (person years) @ $20/unit		Disease Reduction (DALY) @ $40/DALY		10 yr Benefit (minus 25%over-head)	Output Cost	B/C Ratio
	Qty/ yr	$/yr	Qty/ yr	$/yr	Qty/ yr	$/yr	Tot Net[1]	Unit Cost	
Improved Stoves	0.2	$4	0.5	$0.1	0.14	$5.6	$62	$20	3.1:1
Solar Lighting System	0.1	$2	0.7	$14	0.01	$0.4	$123	$150	0.82:1
Sust. Land Mngmnt (ha)	0.9	$18	1.0	$20	0.025	$1	$295	$50	5.9:1
Mangrove forestry (ha)	3.6	$72	1.0	$20	0	$0	$653	$150	4.4:1
Solar Ovens	0.1	$2	0	$0	0.05	$2	$30	$100	0.3:1

[1] Net income from the credits has the 25% marketing and distribution costs deducted

Part 4
Reducing Distribution and Transaction Costs

Typical Steps in Documenting Credits

Register Project: Fill out registration form to record planned projects

Explain Incentive and Rewards: Make agreement with NGO and Village what benefits get to village for what activities

Implement Project: Use prospect of credit funding to raise seed funds and implement project

Monitor Implementation: Visit project after implementation to collect monitoring data.

Verify Credits: After implementation is done, independent/academic verifier visits project, reviews data and provides verification report for claimed credits

Certify and Sell: Based on sales contracts, certify, invoice and receive payment for verified, certified credits. Retail and philanthropy market can be more flexible than this.

Cost Reduction Methods

Constrain overhead budget to 25% of gross revenues

This means that foreigners get paid last (their labor costs are up to 1000 times higher than village labor)

Bulk, wholesale purchases of equipment (drops cost of equipment at capital city by a factor of two)

Villagers or NGO's pick-up bulk equipment purchases in capital (their labor is much cheaper that city slicker labor)

Deal with villages in large groups and statistically subsample for monitoring (drops monitoring costs by a factor of 10)

Automate data collection and data presentation

Part 5
Defining Ownership for Assets and Growth

Build Social Capital: Types of Assets

- Physical infrastructure
- Organization
- Human capacity and education
- Ideas, information, and technologies
- Environment
- Natural resources

Responsibility Delegated to Villagers

- **No gifts**
- **They work to create their own benefits**
- **They can pay for what they want either in cash or with work**
- **If they produce social and environmental value they get credit which is used to discount the price of what they want or do a savings account that can buy equipment they need**
- **Organizers periodically visit to check the projects and verify impacts**
- **If they don't like the deal, no problem, we will go to the next village—there are million villages in Africa**

Combined Lights and Stoves

Do several villages at a time

Give them an initial solar home lighting system (distribute via lottery)

Given them parts and training for building stoves

Demand that villagers build organization and capacity for implementation/maintenance

Buy more lights with carbon credits from stoves

Distribute solar home lights via lottery. One improved stove = one lottery ticket.

Solar Light

Eritrea Improved Stove

Traditional

Improved

How Project Grows Assets

- **Physical infrastructure:** *Lights and stoves are more efficient energy services infrastructure*

- **Organization:** *Village has to organize to make its contribution through stove building*

- **Human capacity and education:** *Training for project, and lights allow big increase in education*

- **Ideas, information, and technologies:** *Villages get access to renewable energy, cell phones, and potentially more technologies*

- **Environment:** *Improved indoor air quality, and lower GHG emissions*

- **Natural resources:** *Enhanced natural resources, more trees, bushes and grass*

SE Market Development

Step #1: Create registry of villages and potential projects

Step #2: Allocate funds to highest performance projects first and foster friendly competition and innovation to improve performance

Step #3: Reduce costs of administration, advertising, monitoring and verification so that fraction invested in projects is maximized. So grants are not needed. Use volunteers efficiently

Step #4: Grow assets and capacity over time

Part 6
Project Plans and
Possible Trajectories

Conclusions and Plans

- $100K of gross cash flow this year and 100 - 200 potential participating villages
- Institutional interest in SE credit model is growing VERY fast
- Hope to grow to about $250K-$500K in gross cash flow and 300 participating villages in 2009
- Consolidate SE market system
- Set up systems for SE market functions: monitoring, evaluation, project registration, crediting, and equipment procurement and distribution
- Develop sophisticated optimization of SE system resource allocations for both capital and expense management

1000 ha of Mangrove Reforestation in Senegal

Testing Stoves in Ghana

Solar Installation in Ghana

Solar Light Raffle Winner in Ghana

- If there is some low-to-no transaction cost demand for social and environmental value, then we can grow social and environmental value production in an economically optimum way

- Volume of available capital should increase with increasing B/C ratio

- B/C ratio of the socio-environmental capital supply curve should vary by a factor of 10,000

- We can collect and aggregate the demand curves from many individual projects and for several different types of social and environmental value to produce an aggregate market demand

- We can work with villages in rural Africa to evaluate and measure their social value supply curves

Example Social Value Demand Offer

Investment Volume	SE Price ($/person-year)	SE Production Volume (person-years)
$100	$10	10
$300	$1	300
$1,000	$0.1	10,000
$3,000	$0.01	100,000
$10,000	$0.001	10,000,000

For a Socio-Environmental Value Demand Offer to work it must provide a greater volume of investment as the SE price drops. SE system can then optimize production based on SE supply.